



PUTTING RESEARCH TO WORK

BRIEF

Are OGFCs Ready to Perform in Wisconsin Weather?

Open-graded friction courses are increasingly being used by state departments of transportation throughout the United States. These pavements are designed with porous aggregate matrixes that quickly drain water from road surfaces, reducing the frequency of wet-weather accidents caused by hydroplaning. OGFCs also improve tire traction and minimize tire spray and noise. As Wisconsin is looking at increasing its application of the perpetual pavement concept, OGFCs may provide another option for the renewable surface layer.

What's the Problem?

Despite their safety benefits, OGFCs have not been used historically in Wisconsin because of questions about their performance. Before 2000, the use of OGFC mixtures nationally led to numerous premature pavement failures and consequently to a rapid decrease in OGFC use.

The most common problem with these pavements involved the separation of asphalt binder from lower layers, or stripping. Stripping is caused by the presence of water, which attracts the binder away from the aggregate. The water that penetrates the porous top layers does not evaporate as readily, making lower layers more susceptible to moisture damage.

OGFCs have additional problems in states with winter environments. They freeze more quickly than other pavements, and removing snow and ice from them is more difficult, requiring much heavier and more frequent applications of deicing salts. They are also prone to loss of bonding, or delamination, as well as construction-related problems. As a consequence, almost all northern states discontinued the use of OGFCs before 2000.

Over the last 10 years, the increased use of polymer binders in OGFC mixtures, better design procedures, and improved construction quality assurance and control procedures has led to a rapid resurgence of the use of these mixtures in warm climate states, often for the purpose of pavement noise reduction. Agencies have resolved the stripping problems in lower layers by improving their design and by using European-style porous mixtures that utilize larger coarse aggregates, less fine aggregate, higher air voids and polymer-modified asphalt.

Research was needed to see if Wisconsin could benefit from the latest generation of OGFC mixtures.

Research Objectives

The primary objectives of this study were to determine if the latest generation of OGFC mixtures can be successfully and economically used in Wisconsin's winter climate, and if so, to recommend mixture design and construction specifications.

Specifically, researchers set out to determine if the wet-weather benefits of less water spray, improved wet-weather traction and reduced noise outweighed the potential increase in winter maintenance problems, higher construction and maintenance costs, and reduced pavement life.

Methodology

Researchers began by defining a cold states study area, including 15 neighboring states, two mountainous states with high use of OGFCs and four Canadian provinces with climates similar to that of Wisconsin. Researchers then conducted a detailed literature review focused on determining whether OGFCs are being used successfully in these states. Finally, they conducted an analysis comparing the cost of OGFCs to that of standard asphalts currently used in Wisconsin.

Project Manager



"Monitoring practices in other states will ultimately help Wisconsin advance its use of the perpetual pavement concept by identifying the technologies most suitable to its conditions."

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Investigator

"While the latest generation of open-graded friction courses is still not viable in Wisconsin's freeze-thaw environment, Wisconsin should revisit the possibility of using OGFCs as the technology is further developed."

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Top view of an OGFC asphalt core. While OGFC pavements help to enhance wet-weather traction and reduce tire spray and noise, they are subject to performance problems in Wisconsin's winter climate.

Results

Researchers found several surveys of states regarding their use of OGFCs between 1988 and 2006. These surveys showed that northern states and provinces are generally discontinuing their use of the new generation of OGFCs. By 2006, Nebraska and Kansas were the only cold weather states using OGFCs, and none of the states or Canadian provinces with climates that duplicate Wisconsin's freeze-thaw environment was using them. Researchers detailed these results in a comprehensive table cross-referencing states with the findings of various surveys and contact information with state agencies. Researchers also showed that OGFCs generally cost 21 percent more to construct than standard HMA pavements and have a shorter life compared to standard HMA mixtures.

However, the literature review showed that Wisconsin may gain some wet-weather performance improvements if it changes current surface mixtures for lightly traveled rural roads to a coarser textured stone matrix asphalt, a mixture developed in Europe to reduce rutting and increase durability by creating contact between aggregate stones.

Implementation and Benefits

Researchers recommend that Wisconsin, like other states in northern climates, not make use of OGFCs until the technology is enhanced for viability in colder weather, with two exceptions:

- First, if further research indicates a large number of wet-weather accidents on HMA pavements without a corresponding number of winter accidents, then an SMA mixture should be considered to remedy this problem. If these accidents are occurring on SMA pavements, an OGFC surface should be considered with the understanding that extra efforts will have to be made to develop deicing and snow removal procedures and to train the local maintenance personnel in these procedures.
- Second, if in the future another northern state routinely uses OGFC pavements, and the winter maintenance and performance of OGFC mixtures are successfully resolved, then Wisconsin should reconsider using OGFCs.

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